## TITLE OF THE INVENTION

PACKET COMMUNICATION TERMINAL, PACKET
COMMUNICATION SYSTEM, PACKET COMMUNICATION METHOD, AND
PACKET COMMUNICATION PROGRAM

## 5 BACKGROUND OF THE INVENTION

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[0001] Field of the Invention

[0002] The present invention relates to a packet communication terminal, a packet communication system, a packet communication method, and a packet communication program.

[0003] Related Background Art

years, packet communication recent In [0004] terminals carried by users are spreading as typified by mobile communication terminals and others. The packet communication terminals subject to movement like the migrate terminals communication mobile stations areas established by base communication packet different networks. When a belonging to communication terminal migrates between communication areas of different networks, the packet communication terminal is assigned different network addresses in the respective networks connected before and after the Mobile-IP is known as a technique migration. enabling the packet communication terminal assigned the different addresses before and after the migration as described, to communicate with a correspondent packet

communication terminal. In Mobile-IP, a home agent (HA), which is a management node in a home network (HN) as a network to which the packet communication terminal originally belongs, and a foreign agent (FA), which is a management node in a foreign network (FN) being the other network, broadcast an agent advertisement in their network under management thereof. This agent advertisement is provided with the Life-Time field. For example, let us suppose a case where a packet communication terminal migrates from its HNWhen the packet communication terminal certain FN. fails to receive a new agent advertisement from the HN even after an elapsed time indicated in the Life-Time field of the agent advertisement received last in the HN, it acknowledges that it has moved off the HN. the packet communication terminal receives an agent advertisement in the staying FN, and it acknowledges that it has moved into the FN. Then the packet communication terminal proceeds to the following registration process in order to implement packet communication in the staying FN. In this registration process, first, the packet communication terminal sends a registration request to the FA. This registration request is sent with a c/o (care-of) address of the packet communication terminal in the FN from the FA to Then the HA registers the c/o address of the the HA.

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packet communication terminal and the network address of the packet communication terminal in correlation with each other, and then sends a registration response This registration response is forwarded to the FA. from the FA to the packet communication terminal to be received by the packet communication terminal, thus completing the registration process. Thereafter, when packet correspondent from a sent is packet communication terminal to the network address assigned by the HA, the HA adds the c/o address to this packet, encapsulates it, and then forwards the encapsulated packet to the FA. The FA removes the c/o address from the packet sends the packet to packet and communication terminal. Mobile-IP as described above from the communication the packet implements correspondent packet communication terminal to the migrating packet communication terminal.

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[0005] In the case where the packet communication terminal migrates from the HN to the FN, however, the migrating packet communication terminal is unable to receive a packet transmitted from the correspondent packet communication terminal during a period between a time when it has received the last agent advertisement in the network before the migration and a time of completion of the aforementioned registration process. A technique of decreasing the period in which the

packet communication terminal is unable to receive any packet because of the migration is a technique of decreasing the above-described packet undelivered period by letting a base station controller perform the aforementioned registration process with the HA at a time of completion of a handover process executed on the occasion of a migration between base stations (e.g., Japanese Patent Application Laid-Open No. 2002-191066).

## 10 SUMMARY OF THE INVENTION

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However, aforementioned Mobile-IP and the [0006] technique described in Japanese Patent Application Laid-Open No. 2002-191066 have the problem that there remains not a little time of delay in the packet communication between the packet communication terminal different networks, and between migrating correspondent packet communication terminal. result, there occurs delay of data recovered from interruption in result as to so packets, communication demanding the real time property, for example, as in voice communication or the like.

[0007] The present invention has been accomplished in order to solve the above problem and an object of the present invention is to provide a packet communication terminal, a packet communication system, a packet communication method, and a packet

communication program capable of implementing delayfree packet communication with a correspondent packet communication terminal even during migration between different networks.

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In order to achieve the above object, a [8000] packet communication terminal according to the present invention is a packet communication terminal for packet communication comprising: network address acquiring means for acquiring a network address of the packet communication terminal from a network to which the packet communication terminal can be connected; network address storing means for storing the network address acquired by the network address acquiring for notifying notifying means address network correspondent packet communication terminal of the network address stored in the network address storing means; and first packet receiving means for receiving a packet sent from the correspondent packet communication terminal to the network address; wherein when there exist a plurality of networks to which the packet communication terminal can be connected, the network a plurality of acquiring means acquires address respective the addresses from network aforesaid networks; wherein the network address storing means stores the plurality of network addresses; wherein the notifies the means notifying address network

correspondent packet communication terminal of the plurality of network addresses; and wherein the first packet receiving means receives packets generated from identical data and sent from the correspondent packet communication terminal to the respective network addresses.

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In order to achieve the above object, a [0009] packet communication program according to the present invention is a packet communication program for letting a packet communication terminal function as: network address acquiring means for acquiring a network address of the packet communication terminal from a network to communication terminal packet the which connected; network address storing means for storing the network address acquired by the network address acquiring means; network address notifying means for notifying a correspondent packet communication terminal of the network address stored in the network address storing means; and first packet receiving means for receiving a packet sent from the correspondent packet communication terminal to the network address; wherein when there exist a plurality of networks to which the packet communication terminal can be connected, network address acquiring means acquires a plurality of respective the from addresses aforesaid network networks; wherein the network address storing means stores the plurality of network addresses; wherein the the notifies means notifying address network correspondent packet communication terminal of the plurality of network addresses; and wherein the first packet receiving means receives packets generated from identical data and sent from the correspondent packet respective network communication terminal to the addresses.

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In order to achieve the above object, a [0010] packet communication terminal according to the present invention is a packet communication terminal for packet communication comprising: destination network address storing means for storing a network address notified of by a correspondent packet communication terminal, as a destination network address; second packet generating from data generating a packet for transmitted to the correspondent packet communication terminal; and second packet transmitting means for transmitting the packet to the correspondent packet communication terminal; wherein when a plurality of aforesaid network addresses are notified of by the the terminal, communication packet correspondent destination network address storing means stores a plurality of aforesaid destination network addresses corresponding to the plurality of network addresses; and wherein when a plurality of aforesaid destination network addresses are stored in the destination network address storing means, the second packet transmitting means transmits aforesaid packets generated from identical data, to the respective destination network addresses.

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In order to achieve the above object, [0011] packet communication program according to the present invention is a packet communication program for letting terminal function packet communication destination network address storing means for storing a network address notified of by a correspondent packet а destination communication terminal, as address; second packet generating means for generating transmitted to be data to from packet correspondent packet communication terminal; and second packet transmitting means for transmitting the packet the correspondent packet communication terminal; wherein when a plurality of aforesaid network addresses correspondent notified of by the communication terminal, the destination network address plurality aforesaid a of stores storing means destination network addresses corresponding to plurality of network addresses; and wherein when a plurality of aforesaid destination network addresses are stored in the destination network address storing means, the second packet transmitting means transmits aforesaid packets generated from identical data, to the respective destination network addresses.

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In order to achieve the above object, a [0012] packet communication system according to the present invention is a packet communication system for packet communication between a first packet communication terminal and a second packet communication terminal, terminal packet communication first wherein the for means acquiring address network comprises: acquiring a network address of the packet communication terminal from a network to which the first packet network connected; can be terminal communication address storing means for storing the network address acquired by the network address acquiring means; network address notifying means for notifying the second packet communication terminal of the network address stored in the network address storing means; and first packet receiving means for receiving a packet sent from the second packet communication terminal to packet second the wherein address; network the communication terminal comprises: destination network address storing means for storing the network address notified of by the first packet communication terminal, packet second destination network address; generating means for generating a packet from data to the first packet communication transmitted to

terminal; and second packet transmitting means for packet first the packet to transmitting the communication terminal; wherein when there exist a plurality of networks to which the first packet communication terminal can be connected, the network packet first of the acquiring means plurality acquires a terminal communication respective the from addresses aforesaid network networks; wherein the network address storing means of the first packet communication terminal stores the plurality of network addresses; wherein the network packet first of the address notifying means communication terminal notifies the second packet communication terminal of the plurality of network addresses; wherein when a plurality of aforesaid network addresses are notified of by the first packet communication terminal, the destination network address storing means of the second packet communication terminal stores a plurality of aforesaid destination network addresses corresponding to the plurality of plurality of network addresses; wherein when a aforesaid destination network addresses are stored in the destination network address storing means, the second packet transmitting means of the second packet communication terminal transmits aforesaid packets generated from identical data, to the respective

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destination network addresses; and wherein the first packet receiving means of the first packet communication terminal receives the packets generated from the identical data and transmitted from the second packet communication terminal to the respective network addresses.

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In order to achieve the above object, a [0013] packet communication method according to the present invention is a packet communication method for packet communication between a first packet communication terminal and a second packet communication terminal, the packet communication method comprising: a network address acquiring step wherein network address acquiring means of the first packet communication terminal acquires a network address of the packet communication terminal from a network to which the first packet communication terminal can be connected; a network address storing step wherein network address communication the first packet storing means οf terminal stores the network address acquired by the network address acquiring means; a network address notifying step wherein network address notifying means of the first packet communication terminal notifies the second packet communication terminal of the network address stored in the network address storing means; a address storing step destination network wherein destination network address storing means of the second network the stores communication terminal packet address notified of by the first packet communication terminal, as a destination network address; a first packet generating step wherein second packet generating of the second packet communication terminal generates a packet from data to be transmitted to the first packet communication terminal; a first packet transmitting step wherein second packet transmitting means of the second packet communication terminal transmits the packet to the first packet communication terminal; and a first packet receiving step wherein the first packet first packet receiving means of communication terminal receives the packet transmitted from the second packet communication terminal to the network address address; wherein in the network plurality of acquiring step, when there exist a communication first packet which the networks to address network connected, the be can terminal first packet communication acquiring means of the terminal acquires a plurality of aforesaid network addresses from the respective networks; wherein in the network address storing step the network address communication the first packet storing means οf terminal stores the plurality of network addresses; wherein in the network address notifying step the

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network address notifying means of the first packet communication terminal notifies the second packet communication terminal of the plurality of network addresses; wherein in the destination network address storing step, when a plurality of aforesaid network packet first by the are notified οf addresses communication terminal, the destination network address the second packet communication means of terminal stores a plurality of aforesaid destination to the respective network addresses corresponding packet first the wherein in addresses; network transmitting step, when a plurality of aforesaid are stored addresses destination network destination network address storing means, the second packet second transmitting means of the packet transmits aforesaid packets communication terminal the respective data, to from identical generated destination network addresses; and wherein in the first packet receiving step the first packet receiving means of the first packet communication terminal receives the identical data generated from the packets second packet communication the from transmitted respective destination network the terminal to addresses.

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25 [0014] According to these aspects of the invention, when the first packet communication terminal

as a migrating packet communication terminal moves, for example, to a location where communication areas of two more networks overlap each other, and becomes connectible to each of the networks, the network address acquiring means acquires network addresses from the respective networks. The network address storing means stores these network addresses and the network address notifying means notifies the second packet a correspondent terminal as communication communication terminal of the network addresses. packet communication terminal, the second the destination network address storing means stores the network addresses thus notified of, as respective destination network addresses. Then the second packet transmitting means transmits packets generated from identical data by the second packet generating means, to the respective destination network addresses stored in the destination network address storing means. the first packet communication terminal, the first packet receiving means receives the packets transmitted to the respective destination network addresses from generated packets above, as described identical data. In the case where the first packet communication terminal is present at the location where communication areas of multiple networks overlap each other and is connectible to the networks, the second

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packets to the network addresses acquired from the respective networks, as described above. Even if the first packet communication terminal becomes no longer able to stay connected to any one of the networks because of further migration, it can also receive packets from the second packet communication terminal through the other networks without delay.

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[0015] In the packet communication terminal of the present invention, when a plurality of aforesaid destination network addresses are stored in the destination network address storing means, the packets transmitted to the plurality of network addresses by the second packet transmitting means may be packets identical to each other.

[0016] In the packet communication program of the present invention, when a plurality of aforesaid destination network addresses are stored in the destination network address storing means, the packets transmitted to the plurality of network addresses by the second packet transmitting means may be packets identical to each other.

[0017] In the packet communication system of the present invention, when a plurality of aforesaid destination network addresses are stored in the destination network address storing means, the packets

transmitted to the respective destination network addresses by the second packet transmitting means of the second packet communication terminal may be packets identical to each other.

[0018] In the packet communication method of the present invention, in the first packet transmitting step, when a plurality of aforesaid destination network addresses are stored in the destination network address storing means, the packets transmitted to the respective destination network addresses by the second packet transmitting means of the second packet communication terminal may be packets identical to each other.

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of the aspects these to According [0019] invention, when there are a plurality of destination network addresses notified of by the first packet communication terminal and stored in the destination storing means, the second network address communication terminal sends identical packets to the respective destination network addresses. Therefore, even if the first packet communication terminal becomes no longer able to stay connected to any one of the migration, the first of networks because communication terminal can receive packets transmitted assigned by the addresses network the to networks. As a result, the first packet communication terminal can receive packets transmitted from the second packet communication terminal, without delay.

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communication packet Preferably, the [0020] terminal of the present invention further comprises second redundant packet generating means for generating redundant packets by forward error correction codes from data part of the packets generated by the second packet generating means; and when a plurality of aforesaid destination network addresses are stored in the destination network address storing means, distributes packet transmitting means second transmits the packets generated by the second packet generating means and the redundant packets generated by the second redundant packet generating means, to the plurality of destination network addresses in such a manner that even in a case where any one of the destination network addresses becomes ineffective, the correspondent packet communication terminal can receive different packets in the number equal to or greater than the number of packets generated by the second packet generating means.

[0021] Preferably, the packet communication program of the present invention lets the packet communication terminal further function as: second redundant packet generating means for generating redundant packets by forward error correction codes

from data part of the packets generated by the second and when a plurality of packet generating means; aforesaid destination network addresses are stored in the destination network address storing means, second packet transmitting means distributes and transmits the packets generated by the second packet generating means and the redundant packets generated by the second redundant packet generating means, to the plurality of destination network addresses in such a manner that even in a case where any one of destination network addresses becomes ineffective, the correspondent packet communication terminal can receive different packets in the number equal to or greater than the number of packets generated by the second packet generating means.

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in the packet communication Preferably, [0022] the present invention, the second packet system of second comprises further terminal communication generating for generating means packet redundant redundant packets by forward error correction codes from data part of the packets generated by the second packet generating means; and when a plurality of aforesaid destination network addresses are stored in the destination network address storing means, second packet transmitting means of the second packet communication terminal distributes and transmits the packets generated by the second packet generating means and the redundant packets generated by the second redundant packet generating means, to the plurality of destination network addresses in such a manner that even in a case where any one of the destination network addresses becomes ineffective, the first packet communication terminal can receive different packets in the number equal to or greater than the number of packets generated by the second packet generating means.

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Preferably, the packet communication method [0023] of the present invention further comprises a first second generating wherein step packet redundant redundant packet generating means of the second packet communication terminal generates redundant packets by forward error correction codes from data part of the packets generated by the second packet generating means; and in the first packet transmitting step, when a plurality of aforesaid destination network addresses are stored in the destination network address storing means, the second packet transmitting means of the second packet communication terminal distributes transmits the packets generated by the second packet generating means and the redundant packets generated by the second redundant packet generating means, to the plurality of destination network addresses in such a manner that even in a case where any one of the destination network addresses becomes ineffective, the first packet communication terminal can receive different packets in the number equal to or greater than the number of packets generated by the second packet generating means.

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the aspects of these to According invention, the second packet communication terminal the second redundant packet generating means generate redundant packets by forward error correction Then the second codes from data part of packets. packet transmitting means distributes and transmits the redundant packets and the packets generated by the second packet generating means, to the respective destination network addresses. This distribution is effected in such a manner that even if any one of the becomes addresses network destination ineffective, the first packet communication terminal can receive different packets in the number equal to or greater than the number of packets generated by the second packet generating means. Therefore, the first packet communication terminal can receive the packets in the number that permits recovery of the above data. As a result, the first packet communication terminal can receive packets transmitted from the second packet communication terminal, without delay.

100251 Preferably, the packet communication terminal of the present invention further comprises ineffective network address notifying means for notifying the correspondent packet communication terminal of the network address acquired by the network address acquiring means from the network to which the packet communication terminal is no longer able to stay connected, and information that the network address is made ineffective.

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10 [0026] Preferably, the packet communication program of the present invention lets the packet communication terminal further function as: ineffective network address notifying means for notifying the correspondent packet communication terminal of 15 acquired by the network network address address acquiring means from the network to which the packet communication terminal is no longer able to stay connected, and information that the network address is made ineffective.

20 Preferably, in the packet communication [0027] terminal of the present invention, based on the network notified of by the correspondent packet address communication terminal, and information that network address is made ineffective, the destination 25 network address storing means makes ineffective the destination network address corresponding to the network address.

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program of the present invention, based on the network address notified of by the correspondent packet communication terminal, and information that the network address is made ineffective, the destination network address storing means makes ineffective the destination network address.

Preferably, in the packet communication [0029] 10 system of the present invention, the first packet communication terminal further comprises ineffective network address notifying means for notifying the second packet communication terminal of the network address acquired by the network address acquiring means 15 packet first the which network to the from longer able to stay communication terminal is no connected, and information that the network address is made ineffective; and based on the network address notified of by the first packet communication terminal 20 and the information that the network address is made ineffective, the destination network address storing means of the second packet communication terminal makes address network destination ineffective the corresponding to the network address. 25

[0030] Preferably, the packet communication method

present invention further comprises the οf address notifying step wherein ineffective network ineffective network address notifying means of the first packet communication terminal notifies the second packet communication terminal of the network address acquired by the network address acquiring means from the network to which the first packet communication terminal is no longer able to stay connected, and made is address network the information that address destination network ineffective; and а disabling step wherein, based on the network address notified of by the first packet communication terminal and the information that the network address is made ineffective, the destination network address storing means of the second packet communication terminal makes address destination network the ineffective corresponding to the network address.

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invention, the first packet communication terminal makes the ineffective network address notifying means notify the second packet communication terminal of a network address acquired from a network to which the first packet communication terminal is no longer able to stay connected, together with information indicating the fact. Based on this notification, the second packet communication terminal makes ineffective the

destination network address corresponding to the network address thus notified of, whereby it becomes feasible to cut down the waste that the second packet communication terminal sends packets to the network to which the first packet communication terminal is no longer able to stay connected.

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communication packet the Preferably, terminal of the present invention further comprises radio wave intensity measuring means for, when a plurality of aforesaid network addresses are stored in measuring means, storing address network the intensities of radio waves from the respective networks which the respective network addresses acquired; and effective network address notifying means for, when a maximum intensity out of the intensities measured by the radio wave intensity measuring means is first predetermined threshold, а than less communication packet correspondent the notifying terminal of the network address acquired by the network having network from the acquiring means address transmitted the radio wave of the maximum intensity, and information that a communication state with the aforesaid network is good.

[0033] Preferably, the packet communication program of the present invention lets the packet communication terminal further function as: radio wave

intensity measuring means for, when a plurality of aforesaid network addresses are stored in the network address storing means, measuring intensities of radio waves from the respective networks from which the network addresses were acquired; respective effective network address notifying means for, when a maximum intensity out of the intensities measured by the radio wave intensity measuring means is not less than a first predetermined threshold, notifying the correspondent packet communication terminal the address acquired by the network address network acquiring means from the network having transmitted the radio wave of the maximum intensity, and information that a communication state with the aforesaid network is good.

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in the packet communication Preferably, [0034] terminal of the present invention, when a plurality of aforesaid destination addresses are stored in the destination address storing means, based on the network the correspondent packet by notified οf address information that communication terminal, and communication state with the network from which the aforesaid network address was acquired is good, second packet transmitting means transmits aforesaid packets to the destination network address stored corresponding to the network address in the destination network address storing means.

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Preferably, in the packet communication program of the present invention, when a plurality of aforesaid destination addresses are stored in the destination address storing means, based on the network the correspondent packet notified of by that information and terminal, communication communication state with the network from which the aforesaid network address was acquired is good, the second packet transmitting means transmits aforesaid packets to the destination network address corresponding to the network address in the destination network address storing means.

Preferably, the packet communication system [0036] of the present invention further comprises radio wave intensity measuring means for, when a plurality of aforesaid network addresses are stored in the network address storing means, measuring intensities of radio waves from the respective networks from which the acquired; and respective network addresses were effective network address notifying means for, when a maximum intensity out of the intensities measured by the radio wave intensity measuring means is not less than a first predetermined threshold, notifying the second packet communication terminal of the network address acquired by the network address acquiring means from the network having transmitted the radio wave of that information and intensity, maximum the communication state with the aforesaid network is good; and when a plurality of aforesaid destination addresses are stored in the destination address storing means, based on the network address notified of by the first packet communication terminal, and the information that a communication state with the network from which the aforesaid network address was acquired is good, the second packet transmitting means of the second packet communication terminal transmits aforesaid packets to the destination network address stored corresponding to the network address in the destination network address storing means.

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Preferably, the packet communication method [0037] of the present invention further comprises a radio wave 15 intensity measuring step wherein when a plurality of aforesaid network addresses are stored in the network address storing means, radio wave intensity measuring packet communication terminal of the first 20 measures intensities of radio waves from the respective networks from which the respective network addresses address effective network an and acquired; notifying step wherein when a maximum intensity out of the intensities measured by the radio wave intensity measuring means is not less than a first predetermined 25

threshold, effective network address notifying means of the first packet communication terminal notifies the second packet communication terminal of the network address acquired by the network address acquiring means from the network having transmitted the radio wave of information that intensity, and maximum the communication state with the aforesaid network is good; in the first packet transmitting step, when a plurality of aforesaid destination addresses are stored in the destination address storing means, based on the network address notified of by the first packet communication terminal, and the information that a communication state with the network from which the aforesaid network address was acquired is good, the second packet transmitting means of the second packet communication terminal transmits aforesaid packets to the destination network address stored corresponding to the network address in the destination network address storing means.

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aspects οf these According to [0038] invention, when the first packet communication terminal is connected to two or more networks, the first packet communication terminal makes the radio wave intensity measuring means measure intensities of radio waves from the respective networks. When the maximum intensity 25 out of the plurality of measured intensities is not

the first predetermined threshold, less than effective network address notifying means notifies the second packet communication terminal of the network address acquired from the network having transmitted the radio wave of the maximum intensity, and the communication state with information that the second packet The good. network is relevant packet second the makes terminal communication transmitting means transmit packets to the destination network address corresponding to the network address Namely, in the included in the above notification. network transmitting the radio wave of the intensity being not less than the first predetermined threshold and being maximum among the multiple networks, it is assumed that the first packet communication terminal is located near a base station belonging to the network and is in a good communication state. Therefore, under a judgment that this connection state can be maintained for the time being, the second packet communication terminal transmits packets to the above destination Therefore, the first network address notified of. packet communication terminal can receive the packets second packet communication the transmitted from terminal, without delay and it is feasible to cut down the waste that the second packet communication terminal transmits packets through all the networks to which the

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first packet communication terminal can be connected.

communication the packet Preferably, terminal of the present invention further comprises communication state notifying means for, when all the intensities of the radio waves from the plurality of networks measured by the radio wave intensity measuring smaller than a second predetermined correspondent packet the notifying threshold, communication terminal of information that there is no network from that the packet communication terminal can receive a radio wave of not less than the second predetermined threshold.

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communication packet Preferably, the [0040] program of the present invention lets the packet function further terminal communication communication state notifying means for, when all the intensities of the radio waves from the plurality of networks measured by the radio wave intensity measuring predetermined second a smaller than are means correspondent packet the notifying threshold, communication terminal of information that there is no network from that the packet communication terminal can receive a radio wave of not less than the second predetermined threshold.

25 [0041] Preferably, in the packet communication terminal of the present invention, based on information

that there is no network from that the correspondent packet communication terminal can receive a radio wave of not less than a second predetermined threshold, notified of by the correspondent packet communication terminal, the second packet transmitting means transmits the packets to the respective destination network addresses stored in the destination network address storing means.

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in the packet communication Preferably, [0042] program of the present invention, based on information that there is no network from that the correspondent packet communication terminal can receive a radio wave of not less than a second predetermined threshold, notified of by the correspondent packet communication transmitting packet second terminal, the transmits the packets to the respective destination network addresses stored in the destination network address storing means.

[0043] Preferably, in the packet communication system of the present invention, the first packet communication terminal further comprises communication state notifying means for, when all the intensities of the radio waves from the plurality of networks measured by the radio wave intensity measuring means are smaller than a second predetermined threshold, notifying the second packet communication terminal of information

that there is no network from that the first packet communication terminal can receive a radio wave of not less than the second predetermined threshold; and based on the information that there is no network from that the first packet communication terminal can receive a radio wave of not less than the second predetermined packet first the bу οf notified threshold, communication terminal, the second packet transmitting second packet communication terminal the of transmits the packets to the respective destination network addresses stored in the destination network address storing means.

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Preferably, the packet communication method [0044] comprises further invention present communication state notifying step wherein when all the the intensities of the radio waves from the plurality of networks measured by the radio wave intensity measuring predetermined second а than smaller are means threshold, communication state notifying means of the first packet communication terminal notifies the second packet communication terminal of information that there is no network from that the first packet communication terminal can receive a radio wave of not less than the second predetermined threshold; and in the first packet transmitting step, based on the information that there is no network from that the first packet communication terminal can receive a radio wave of not less than the second predetermined threshold, notified of by the first packet communication terminal, the second packet transmitting means of the second packet communication terminal transmits the packets to the respective destination network addresses stored in the destination network address storing means.

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the of aspects these According to invention, when the intensities of the radio waves from the respective networks measured by the above radio wave intensity measuring means are smaller than the packet first second predetermined threshold, the communication terminal makes the communication state notifying means notify the second packet communication terminal of the information indicating that fact. second packet communication terminal transmits packets to the respective destination network addresses stored in the destination network address storing means, based Namely, when the intensities of on the notification. the radio waves from the respective networks measured by the radio wave intensity measuring means are smaller is second predetermined threshold, it the than determined that the first packet communication terminal is located in a boundary region among communication areas of the respective networks, and thus the second packet communication terminal transmits packets to the respective destination network addresses corresponding to the respective network addresses acquired from these networks by the first packet communication terminal. Even if the first packet communication terminal moves from the boundary region among networks to become no longer be able to stay connected to any one of the networks, the first packet communication terminal can still receive packets transmitted through the other networks from the second packet communication terminal, without delay.

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order to achieve the In another packet communication terminal according to the [0046] present invention is a packet communication terminal for packet communication comprising: network address acquiring means for acquiring a network address of the packet communication terminal from a network to which the packet communication terminal can be connected; network address storing means for storing the network address acquired by the network address acquiring means; network address notifying means for notifying a correspondent packet communication terminal of the network address stored in the network address storing means; first packet generating means for generating a packet from data to be transmitted to the correspondent first communication terminal; and packet transmitting means for providing the packet with the network address stored in the network address storing transmitting the packet for and means correspondent packet communication terminal; wherein when there exist a plurality of networks to which the packet communication terminal can be connected, the network address acquiring means acquires a plurality of respective the from addresses network aforesaid networks; wherein the network address storing means stores the plurality of network addresses; wherein the the notifies means notifying address network correspondent packet communication terminal plurality of network addresses; and wherein when a plurality of aforesaid network addresses are stored in the network address storing means, the first packet transmitting means provides aforesaid packets generated from identical data by the first packet generating means, with the network addresses acquired from the respective networks and transmits the packets to the respective networks.

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another packet communication program according to the present invention is a packet communication program for letting a packet communication terminal function as: network address acquiring means for acquiring a network address of the packet communication terminal from a network to which the packet communication terminal can

be connected; network address storing means for storing the network address acquired by the network address acquiring means; network address notifying means for notifying a correspondent packet communication terminal of the network address stored in the network address storing means; first packet generating means generating a packet from data to be transmitted to the correspondent packet communication terminal; and first packet transmitting means for providing the packet with network address stored in the network address storing means and for transmitting the packet to the correspondent packet communication terminal; wherein when there exist a plurality of networks to which the packet communication terminal can be connected, network address acquiring means acquires a plurality of respective from the addresses aforesaid network networks; wherein the network address storing means stores the plurality of network addresses; wherein the the notifies means notifying address network correspondent packet communication terminal of plurality of network addresses; and wherein when a plurality of aforesaid network addresses are stored in the network address storing means, the first packet transmitting means provides aforesaid packets generated from identical data by the first packet generating means, with the network addresses acquired from the

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respective networks and transmits the packets to the respective networks.

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In order to achieve the above object, [0048] another packet communication terminal according to the present invention is a packet communication terminal communication comprising: destination packet network address storing means for storing a network notified of by a correspondent packet address terminal, as a destination network communication address; and second packet receiving means receiving a packet transmitted from the correspondent packet communication terminal; wherein when a plurality of aforesaid network addresses are notified of by the correspondent packet communication terminal, the destination network address storing means stores a plurality of aforesaid destination network addresses corresponding to the respective network addresses; and wherein the second packet receiving means receives a packet transmitted from the correspondent communication terminal, provided with one of the destination network addresses, plurality of and generated from identical data.

[0049] In order to achieve the above object, another packet communication program according to the present invention is a packet communication program for letting a packet communication terminal function as:

destination network address storing means for storing a network address notified of by a correspondent packet network communication terminal, as a destination means receiving packet second and address; receiving a packet transmitted from the correspondent packet communication terminal; wherein when a plurality of aforesaid network addresses are notified of by the the terminal, communication packet correspondent destination network address storing means stores a plurality of aforesaid destination network addresses corresponding to the respective network addresses; and wherein the second packet receiving means receives a packet correspondent transmitted from the packet the communication terminal, provided with one and addresses, destination network οf plurality generated from identical data. above object,

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achieve the order to In [0050] another packet communication system according to the present invention is a packet communication system for packet first between а communication packet packet second a terminal and communication packet first the wherein terminal, communication address network comprises: terminal communication acquiring means for acquiring a network address of the packet communication terminal from a network to which first packet communication terminal can be the

connected; network address storing means for storing the network address acquired by the network address acquiring means; network address notifying means for notifying the second packet communication terminal of the network address stored in the network address generating means first packet storing means; generating a packet from data to be transmitted to the second packet communication terminal; and first packet transmitting means for providing the packet with the network address stored in the network address storing means and for transmitting the packet to the second packet communication terminal; wherein the packet communication terminal comprises: destination network address storing means for storing a network address notified of by the first packet communication terminal, as a destination network address; and second for receiving packet а means packet receiving communication packet first the transmitted from there exist a plurality of terminal; wherein when the first packet communication networks to which network be connected, the can terminal acquiring means of the first packet communication terminal acquires a plurality of aforesaid network addresses from the respective networks; wherein the network address storing means of the first packet communication terminal stores the plurality of network

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addresses; wherein the network address notifying means of the first packet communication terminal notifies the second packet communication terminal of the plurality of network addresses; wherein when a plurality of aforesaid network addresses are notified of by the first packet communication terminal, the destination network address storing means of the second packet communication terminal stores a plurality of aforesaid destination network addresses corresponding to respective network addresses; wherein when a plurality of aforesaid network addresses are stored in packet first means, the network address storing transmitting means of the first packet communication terminal provides aforesaid packets generated from identical data by the first packet generating means, with the network addresses acquired from the respective networks and transmits the packets to the respective networks; and wherein the second packet receiving means of the second packet communication terminal receives a packet transmitted from the first packet communication terminal, provided with one of the plurality of network addresses, and generated from the identical data. In order to achieve the above object, [0051]

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another packet communication method of the present invention is a packet communication method for packet communication between a first packet communication

terminal and a second packet communication terminal, the packet communication method comprising: a network wherein network address acquiring step address acquiring means of the first packet communication terminal acquires a network address of the packet communication terminal from a network to which the first packet communication terminal can be connected; a network address storing step wherein network address first packet communication storing means of the terminal stores the network address acquired by the network address acquiring means; a network address notifying step wherein network address notifying means of the first packet communication terminal notifies the second packet communication terminal of the network address stored in the network address storing means; a destination network address storing step wherein destination network address storing means of the second packet communication terminal stores the address notified of by the first packet communication terminal, as a destination network address; a second packet generating step wherein first packet generating the first packet communication terminal means of generates a packet from data to be transmitted to the second packet communication terminal; a second packet transmitting step wherein first packet transmitting means of the first packet communication terminal

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provides the packet with the network address stored in the network address storing means and transmits the packet to the second packet communication terminal; and a second packet receiving step wherein second packet receiving means of the second packet communication terminal receives the packet transmitted from the first packet communication terminal; wherein in the network address acquiring step, when there exist a plurality of networks to which the first packet communication connected, terminal can be the network address acquiring means of the first packet communication terminal acquires a plurality of aforesaid network addresses from the respective networks; wherein in the network address storing step the network address the first packet storing means of communication terminal stores the plurality of network addresses; wherein in the network address notifying step the network address notifying means of the first packet communication terminal notifies the second packet communication terminal of the plurality of network addresses; wherein in the destination network address storing step, when a plurality of aforesaid network addresses are notified of by the first packet communication terminal, the destination network address of the second packet communication storing means terminal stores a plurality of aforesaid destination

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network addresses corresponding to the respective the second network addresses; wherein in transmitting step, when a plurality of aforesaid network addresses are stored in the network address storing means, the first packet transmitting means of provides first packet communication terminal aforesaid packets generated from identical data by the first packet generating means, with the network addresses acquired from the respective networks and transmits the packets to the respective networks; and wherein in the second packet receiving step the second packet second the means of packet receiving communication terminal receives a packet transmitted from the first packet communication terminal, provided with one of the plurality of network addresses, and generated from the identical data.

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the of aspects these to According [0052] invention, when the first packet communication terminal a migrating packet communication terminal present, for example, in a location where communication areas of two or more networks overlap each other so as to enable connections to the multiple networks, the network acquires network address acquiring means The network addresses from the respective networks. address storing means stores these network addresses and the network address notifying means notifies the

second packet communication terminal as a correspondent packet communication terminal of the network addresses. the second packet communication terminal, destination network address storing means stores the network addresses thus notified of, as respective destination network addresses. In the first packet communication terminal, the first packet transmitting means provides packets generated from identical data by the first packet generating means, with the above network addresses acquired from the respective networks, and transmits them to the respective networks. In the second packet communication terminal, the second packet receiving means receives a packet provided with one of the above network addresses, as a packet generated from the identical data. In the case where the first packet communication terminal located at the position where the communication areas of multiple networks overlap each other, as described above, it transmits packets generated from identical data, to these networks. Therefore, even if the first packet communication terminal becomes no longer able to stay connected to any one of these networks, the second packet communication terminal can receive the packets sent through the other networks from the first packet communication terminal, without delay.

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[0053] In the packet communication terminal of the

present invention, when a plurality of aforesaid network addresses are stored in the network address storing means, the packets transmitted to the respective networks by the first packet transmitting means may be packets identical to each other.

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[0054] In the packet communication program of the present invention, when a plurality of aforesaid network addresses are stored in the network address storing means, the packets transmitted to the respective networks by the first packet transmitting means may be packets identical to each other.

[0055] In the packet communication system of the present invention, when a plurality of aforesaid network addresses are stored in the network address storing means, the packets transmitted to the respective networks by the first packet transmitting means of the first packet communication terminal may be packets identical to each other.

[0056] In the packet communication method of the present invention, in the second packet transmitting step, when a plurality of aforesaid network addresses are stored in the network address storing means, the packets transmitted to the respective networks by the first packet transmitting means of the first packet communication terminal may be packets identical to each other.

the aspects these According to [0057] invention, when the first packet communication terminal is connectible to two or more networks, it transmits identical packets generated from identical data, to the Therefore, even if the first respective networks. packet communication terminal becomes unable to stay connected to any one of these networks because of migration, the second packet communication terminal can receive the packets transmitted through the other packet first the from networks connectible communication terminal. As a result, the second packet packets receive the can communication terminal communication first packet transmitted from the terminal, without delay.

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communication packet Preferably, the [0058] terminal of the present invention further comprises first redundant packet generating means for generating redundant packets by forward error correction codes from data part of aforesaid packets generated by the first packet generating means, and the first packet transmitting means distributes and transmit the packets 20 generated by the first packet generating means and the redundant packets generated by the first redundant packet generating means, to the networks in such a packet the where case a in even that manner 25 communication terminal is no longer able to

connected to any one of the plurality of networks, the correspondent packet communication terminal can receive different packets in the number equal to or greater than the number of packets generated by the first packet generating means.

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packet communication the Preferably, [0059] program of the present invention lets the packet terminal further function as communication generating for means generating redundant packet redundant packets by forward error correction codes from data part of aforesaid packets generated by the first packet generating means, and the first packet transmitting means distributes and transmits packets generated by the first packet generating means the redundant packets generated by the first redundant packet generating means, to the networks in such a manner that even in a case where the packet longer able to stay communication terminal is no connected to any one of the plurality of networks, the correspondent packet communication terminal can receive different packets in the number equal to or greater than the number of packets generated by the first packet generating means.

[0060] Preferably, the packet communication system
of the present invention further comprises first redundant packet generating means for generating

redundant packets by forward error correction codes from data part of aforesaid packets generated by the first packet generating means of the first packet first the and terminal, communication transmitting means of the first packet communication packets transmits the and distributes terminal generated by the first packet generating means and the redundant packets generated by the first redundant packet generating means, to the networks in such a manner that even in a case where the first packet communication terminal is no longer able to stay connected to any one of the plurality of networks, the packet communication terminal can second different packets in the number equal to or greater than the number of packets generated by the first packet generating means.

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Preferably, the packet communication method of the present invention further comprises a second step wherein first generating packet redundant redundant packet generating means of the first packet communication terminal generates redundant packets by forward error correction codes from data part of packet first generated by the aforesaid packets generating means; and in the second packet transmitting step, the first packet transmitting means of the first packet communication terminal distributes and transmits the packets generated by the first packet generating means and the redundant packets generated by the first redundant packet generating means, to the networks in such a manner that even in a case where the first packet communication terminal is no longer able to stay connected to any one of the plurality of networks, the second packet communication terminal can receive different packets in the number equal to or greater than the number of packets generated by the first packet generating means.

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aspects of the these to According [0062] invention, the first packet communication terminal the first redundant packet generating means makes generate redundant packets by forward error correction codes from data part of packets. Then the first packet transmitting means distributes and transmits the above redundant packets and the packets generated by the first packet generating means, to the networks to which packet communication terminal be can first connected. This distribution is carried out in such a manner that even if the first packet communication terminal becomes no longer able to stay connected to any one of the above networks, the second packet communication terminal can receive different packets in the number equal to or greater than the number of packets generated by the first packet generating means.

Therefore, even if the first packet communication terminal becomes no longer able to stay connected to one of the above networks, the second packet communication terminal can receive packets in the number permitting recovery of the above data. As a result, the second packet communication terminal can receive the packets transmitted from the first packet communication terminal, without delay.

## BRIEF DESCRIPTION OF THE DRAWINGS

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Fig. 1 is a diagram showing a configuration of packet communication system 1.

- Fig. 2 is a block diagram showing a functional configuration of a packet communication terminal.
- Fig. 3 is a diagram showing a configuration of a packet used in packet communication according to an embodiment.
  - Fig. 4 is a diagram showing data stored in data part of a packet for notifying a correspondent packet communication terminal of a network address.
- Fig. 5A is a diagram showing data generated from audio-video data.
  - Fig. 5B is a diagram showing divisional data generated from the data shown in Fig. 5A.
    - Fig. 5C is a diagram showing redundant data.
- Fig. 5D is a diagram showing packets generated by adding an MMSP header to each of the divisional data

and redundant data.

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Fig. 5E is a diagram showing packets generated by adding an IP header to each of the packets shown in Fig. 5D.

Fig. 6 is a block diagram showing a functional configuration of packet communication terminal 30.

Fig. 7 is a sequence diagram associated with notification of network addresses during soft handover.

Fig. 8 is a sequence diagram associated with notification of network addresses during soft handover.

Fig. 9 is a flowchart of an ADD\_ADDRESS message sending process.

Fig. 10 is a flowchart of a DELETE\_ADDRESS message sending process.

Fig. 11 is a flowchart of a GOOD\_ADDRESS message sending process.

Fig. 12 is a flowchart of a process executed by a packet communication terminal in response to a received ADD\_ADDRESS message.

Fig. 13 is a flowchart of a process executed by a packet communication terminal in response to a DELETE\_ADDRESS message.

Fig. 14 is a flowchart of a process executed by a packet communication terminal in response to a received GOOD\_ADDRESS message.

Fig. 15 is a flowchart of processing for a packet

communication terminal to transmit packets generated from data and for a correspondent packet communication terminal to reconstruct the data.

Fig. 16 is a flowchart of processing for a packet communication terminal to transmit packets generated from data and for a correspondent packet communication terminal to reconstruct the data.

showing a module diagram is a Fig. 17 configuration of a packet communication program.

diagram showing a module a Fig. 18 is configuration of a packet communication program. 10

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

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Packet communication system 1 according to [0063] embodiment of the present invention will described below with reference to the accompanying showing diagram is a Fig. 1 configuration of packet communication system 1. Packet drawings. according to the present communication system 1 communication packet embodiment is comprised of terminal (first packet communication terminal) 10, terminal (second packet 20 communication packet 30, network 50 with base communication terminal) station 51, network 70 with base station 71, and switching center 80.

Network 50 is a network having a plurality of base stations including base station 51, and the [0064] 25

base station 51 is connected through a link to switching center 80. Network 70 is a network having a plurality of base stations including base station 71, and is connected through a link to switching center 80.

[0065] Each of base station 51 and base station 71 is wirelessly connected to packet communication terminal 10 present in the range of communication area 52 and communication area 72, and operates to transmit and receive packets to and from packet communication terminal 10.

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[0066] Switching center 80 is comprised of a router or the like and implements relaying in packet communication between packet communication terminal 30 and packet communication terminal 10.

described below. Packet communication terminal 10 will be described below. Packet communication terminal 10 is a mobile packet communication terminal carried by a user like the mobile communication terminals, cell phones, and so on. Packet communication terminal 10 is physically equipped with an input device such as push buttons, a display unit such as a display device, a CPU (central processing unit), a storage device such as a memory, a communication device, and so on.

[0068] The functional configuration of packet communication terminal 10 will be described below.

Fig. 2 is a block diagram showing the functional

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configuration of packet communication terminal 10. is functionally Packet communication terminal 10 comprised of network address acquiring part (network address acquiring means) 101, network address storage (network address storing means) 102, network address notifying part (network address notifying means, ineffective network address notifying means, effective network address notifying means, and communication state notifying means) 103, radio wave intensity measuring part (radio wave intensity measuring means) 104, packet receiver (first packet receiving means) 105, data reconstruction part 106, audio-video decoder 107, audio-video encoder 108, data dividing part 109, packet generator (first packet generating means) 110, redundant packet generator (first redundant packet generating means) 111, and packet transmitter (first Each of these packet transmitting means) 112. components will be described below in detail. The network address acquiring part 101 is [0069] configured as follows. Packet communication terminal 10 detects a network to which it can be connected at Then the network address its current location. acquiring part 101 acquires a network address assigned by the detected network and makes the network address

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storage 102 store the network address. For example, in

the case where packet communication terminal

located in communication area 52 of base station 51, it acquires a network address assigned to the packet communication terminal 10 by network 50. When packet communication terminal 10 further moves from this location to a location where it is included in both communication area 52 of base station 51 and communication area 72 of base station 71, the network address acquiring part 101 further acquires another network address from network 70.

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10 [0070] Network address storage 102 is a storage part constructed on a memory for memorizing network addresses acquired by network address acquiring part 101. Alternatively, network address storage 102 may be a database constructed on a hard disk.

Network address notifying part 103 notifies [0071] correspondent packet communication terminal 30 of a network address acquired by the network address acquiring part 101. For example, in the case where communication terminal 10 is located packet in communication area 52 of base station 51, it notifies packet communication terminal 30 of a network address acquired from network 50 by network address acquiring part 101. When packet communication terminal further moves from this location to a location where it is included in both communication area 52 of base station 51 and communication area 72 of base station 71, the network address notifying part 103 further notifies packet communication terminal 30 of a network address acquired from network 70 by network address acquiring part 101.

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Let us explain herein the configuration of packets used in notification of the network address and transmission of data by packet communication terminal 10 as described above, with reference to Fig. 3. Fig. 3 shows the configuration of packet 150 used in packet communication according to the present embodiment. Fig. 3 shows the configuration of packet 150 consisting of the header of the transport layer, which was newly designed by Inventors of the present invention so as to suit the use in packet communication according to the present embodiment, and data part. In the present specification, the header of the transport layer will be called an "MMSP header." As shown in Fig. 3, the MMSP header is provided with various fields such as source port number field 151, destination port number field 152, flag field 160, and so on. The source port number field 151 and destination port number field 152 are provided for storage of a port number indicating a type of an application protocol. Namely, a numeral indicating a type of an application protocol for the present according to the communication packet embodiment is stored in those fields. Flag field 160 consists of DATA field 161, FEC field 162, GOOD\_ADDRESS field 163, ADD\_ADDRESS field 164, and DELETE\_ADDRESS field 165. The data part 170 subsequent to this MMSP field is provided for storage of data to be transmitted in the form of packets.

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packet correspondent notifying For communication terminal 30 of a network address acquired by network address acquiring part 101, as described above, the network address notifying part 103 puts "1" in ADD\_ADDRESS field 164 of the MMSP header. Then the network address notifying part 103 stores data of the format shown in Fig. 4, into data part 170. Fig. 4 shows the data to be stored in data part 170 used in the notification of the network address to the packet communication terminal 30. On the occasion of the aforementioned notification of the network address, as shown in Fig. 4, network address notifying part 103 puts a type of an address in address type field 171. For example, a numeral indicating a network address of IPv4 or IPv6 is stored in address type field 171. A numeral indicating a length of the network address notified of is stored in address length field 172. For example, "32" indicating the address length of 32 bits in the case of IPv4, or "128" indicating the address length of 128 bits in the case of IPv6 is stored in address The network address length field 172.

associated with the aforementioned notification is stored in network address field 173.

[0074] For notifying packet communication terminal 30 of the network address acquired by the network address acquiring part 101, the network address notifying part 103 generates a packet of the configuration as described above, and transmits the packet to packet communication terminal 30.

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[0075] When packet communication terminal 10 becomes no longer able to stay connected to a network presently under connection, the network address notifying part 103 puts a network address acquired from the network, in the form of the data of structure shown in Fig. 4, into data part 170 of packet 150, puts "1" in DELETE\_ADDRESS field 165 of the MMSP header, and sends the packet to packet communication terminal 30. Packet communication terminal 10 deletes this network address from network address storage 102.

performs the following processing on the basis of an instruction from radio wave intensity measuring part 104. Now, referring back to Fig. 2, the radio wave intensity measuring part 104 will be described. The radio wave intensity measuring part 104 measures intensities of radio waves from respective networks to which packet communication terminal 10 is connected.

intensity measuring part 104 radio wave The configured so that when a maximum intensity out of a plurality of intensities measured is not less than a predetermined (first predetermined threshold threshold), it detects a network including a base station having transmitted the radio wave of the Then it outputs a network address maximum intensity. acquired from the detected network and stored to network address network address storage 102, notifying part 103. Receiving this output, network address notifying part 103 puts "1" into GOOD\_ADDRESS field 163 of the MMSP header, and sends packet 150 with data part 170 storing data consisting of the network address from the radio wave intensity measuring part 104, to packet communication terminal 30. case, the radio wave intensity measuring part 104 controls packet transmitter 112 so as to send packets to only the network including the base station having transmitted the radio wave of the maximum intensity.

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measured are smaller than a predetermined threshold (second predetermined threshold), the radio wave intensity measuring part 104 outputs this fact to network address notifying part 103. Receiving this output, network address notifying part 103 puts "1" in GOOD\_ADDRESS field 163 of the MMSP header, and sends

packet 150 of structure with no designated network address in data part 170 to packet communication terminal 30. In this case, the radio wave intensity measuring part 104 controls packet transmitter 112 so data to to send packets generated from transmitted to the packet communication terminal 30, to all the networks to which packet communication terminal 10 is connected. The two predetermined thresholds (the second the predetermined threshold and first predetermined threshold) used by radio wave intensity measuring part 104 may be identical to each other, or may be different values.

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packet 105 receives Packet receiver [0078] transmitted from packet communication terminal When a plurality of network addresses are stored in network address storage 102, the packet receiver 105 receives all packets transmitted to these network packet packets addressed to the addresses, as Data reconstruction part communication terminal 10. 106 reconstructs data from the packets received by packet receiver 105. Audio-video decoder 107 decodes the data reconstructed by data reconstruction part 106, into audio and/or video data.

[0079] Audio-video encoder 108 encodes audio 25 and/or video data to be transmitted from packet communication terminal 10 to packet communication terminal 30, to generate encoded data. Data dividing part 109 divides this encoded data into divisional data, for packetizing the data generated by audio-video encoder 108.

5 [0080] Packet generator 110 adds an MMSP header to each of the above divisional data to generate packets. At this time, packet generator 110 puts "1" in DATA field 161 of the MMSP header to indicate that this packet is constructed from data.

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Redundant packet generator 111 generates [0081] redundant data by forward error correction codes from the above divisional data and adds an MMSP header to each of the redundant data to generate redundant packets. At this time, redundant packet generator 111 puts "1" in FEC field 162 of the MMSP header, thereby indicating that this packet contains redundant data by forward error correction codes. Here the redundant packet generator 111 generates redundant packets by the number according to the number of networks to which packet communication terminal 10 is connected. For example, when packet communication terminal connected to two networks, it generates K redundant packets, corresponding to the number of divisional packet communication terminal The data, K. packets redundant the transmits and distributes generated in this way, and the packets generated by the packet generator 110, to the two networks, and the packet communication terminal 30 can reconstruct the data by receiving either the K packets or redundant packets out of these packets and redundant packets. When the maximum intensity of the radio wave out of those measured by radio wave intensity measuring part 104 is not less than the predetermined threshold, packet communication terminal 10 sends the packets to only the network including the base station having transmitted the radio wave, as described above; in this case, therefore, redundant packet generator 111 generates no redundant packet.

header to each of the packets generated by packet generator 110 and to each of the redundant packets generated by the redundant packet generator 111. Then the packet transmitter 112 transmits the packets each with the IP header to packet communication terminal 30. In this transmission, where packet transmitter 112 is controlled by radio wave intensity measuring part 104 so as to send packets to the network including the base station having transmitted the radio wave of the maximum intensity as described above, it sends the packets generated by the packet generator 110, to only the relevant network. On the other hand, when all the intensities of the radio waves measured by the radio

wave intensity measuring part 104 is smaller than the predetermined threshold, packet transmitter 112 controlled so as to send the packets to all networks to which the packet communication terminal 10 is connected, by an instruction from radio wave intensity measuring part 104; in that case, packet transmitter 112 distributes and transmits the packets and redundant packets each with the IP header as described above, to the networks to which the packet On the communication terminal 10 is connected. occasion of this distribution, packet transmitter 112 transmits the packets while storing network addresses acquired from the respective networks, as source addresses of the IP header, according to the networks to which the above packets and redundant packets are to be transmitted. by the

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respective parts of audio-video encoder 108, data divider 109, packet generator 110, redundant packet generator 111, and packet transmitter 112 will be described below with reference to Fig. 5A, Fig. 5B, Fig. 5C, Fig. 5D, and Fig. 5E. First, as shown in Fig. 5A, audio-video encoder 108 encodes audio data, video data, or the like to generate data 201 to be transmitted to packet communication terminal 30. This process (reference numeral 200) is a process executed

in the application layer level. Next, as shown in Fig. 5B, data divider 109 divides data 201 to generate a plurality of divisional data 211-214. Presented here is an example in which four divisional data 211-214 are generated from data 201. Next, as shown in Fig. 5C, redundant packet generator 111 generates redundant data 215-218 by forward error correction codes from the divisional data 211-214. Presented here is an example in which four redundant data are generated. Then, as shown in Fig. 5D, packet generator 110 and redundant packet generator 111 add MMSP headers 221-228 to divisional data 211-214 and to redundant data 215-218, respectively. The processes (reference numeral 210) shown in Figs. 5B, 5C, and 5D are processes each executed in the transport layer level. Thereafter, as shown in Fig. 5E, packet transmitter 112 adds IP headers 241-248 to the respective packets with the MMSP headers and then sends these packets with the IP This process (reference numeral headers to networks. 240) shown in Fig. 5E is a process executed in the network layer level. packet communication Described next is [0084]

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terminal 30 as a correspondent to packet communication terminal 10. Packet communication terminal 30 is a packet communication terminal capable of performing packet communication like the personal computers. In

the present embodiment, the packet communication terminal 30, different from packet communication terminal 10, is not based on the premise of migration and is connected to one network. The packet communication terminal 30 can also be a mobile packet communication terminal like the mobile communication terminals and others if it is comprised of the afterdescribed components of packet communication terminal 30 and the aforementioned functional components of packet communication terminal 40.

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[0085] The packet communication terminal 30 is physically comprised of a CPU (central processing unit), a storage device such as a memory, a storage device such as a hard disk, an input device such as a keyboard and a mouse, a display device such as a display unit, a communication device, and so on.

[0086] Fig. 6 is a block diagram showing the functional configuration of packet communication terminal 30. The packet communication terminal 30, as shown in Fig. 6, is functionally comprised of packet receiver (second packet receiving means) 301, received packet discrimination processor 302, destination network address storage (destination network address storing means) 303, data reconstruction part 304, audio-video decoder 305, audio-video encoder 306, data divider 307, packet generator (second packet generating

means) 308, redundant packet generator (second redundant packet generating means) 309, and packet transmitter (second packet transmitting means) 310. Each of the components will be described below in detail.

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[0087] Packet receiver 301 receives a packet transmitted from correspondent packet communication terminal 10 and outputs it to received packet discrimination processor 302.

Received packet discrimination processor 10 [0088] 302 receives the packet from packet receiver 301. Then it performs the following processing with reference to flag field 160 in the MMSP header of this packet. When "1" is stored in DATA field 161 of the flag field 160, 15 received packet discrimination processor 302 determines that this packet constitutes part of data transmitted from packet communication terminal 10, and outputs this packet to data reconstruction part 304. When "1" is stored in FEC field 162, received packet discrimination 20 processor 302 determines that this packet is one generated from redundant data, and outputs this packet to data reconstruction part 304. When "1" is stored with reference to GOOD ADDRESS field 163, received packet discrimination processor 302 refers to data part 25 170 and determines whether a network address is stored in its network address field 173. When the result of

this determination is that an address is stored in packet received field 173, address network packet controls 302 processor discrimination transmitter 310 so as to transmit packets to only the stored network address. On the other hand, when no network address is designated in network address field 173, received packet discrimination processor controls packet transmitter 310 so as to transmit packets to a plurality of destination network addresses stored in destination network address storage 303. When "1" is stored in ADD\_ADDRESS field 164, received packet discrimination processor 302 makes destination network address storage 303 store a network address stored in network address field 173 of data part 170, as a destination network address. When "1" is stored packet 165, received field DELETE\_ADDRESS discrimination processor 302 deletes a destination network address equivalent to a network address stored in network address field 173 of data part 170, from destination network address storage 303. Destination network address storage [0089]

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stores a network address notified of by packet communication terminal 10, as a destination network address. Destination network address storage 303 may memorize a list of destination network addresses on a memory or may memorize a list of destination network

addresses while constructing a database on a hard disk, for example.

[0090] The data reconstruction part 304, audio-video decoder 305, audio-video encoder 306, data divider 307, and packet generator 308 have the same functions as those of the data reconstruction part 106, audio-video decoder 107, audio-video encoder 108, data divider 109, and packet generator 110 of the packet communication terminal 10, respectively.

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In order to transmit packets to a plurality [0091] of destination network addresses stored in destination network address storage 303, redundant packet generator forward by redundant data generates 309 correction codes from divisional data generated through division of data by data divider 307, and adds the MMSP headers to the redundant data to generate packets. At this time, redundant packet generator 309 puts "1" in the FEC field 162 of the MMSP header of each packet, thereby indicating that this packet contains redundant Here the data by forward error correction codes. redundant packet generator 111 generates redundant packets by the number according to the number of destination network addresses. For example, in the case where packet communication terminal 30 transmits packets to two destination network addresses, it generates K redundant packets, corresponding to the number of divisional data, K. The packet communication terminal 30 distributes and transmits the redundant packets generated in this way and the packets generated by packet generator 308, to the two destination network addresses, whereby packet communication terminal 10 becomes able to reconstruct the data by receiving either the K packets or redundant packets out of these packets and redundant packets. In the case where the packet communication terminal 30 receives from packet communication terminal 10 a packet in which "1" is stored in GOOD\_ADDRESS field 163 and in which a network address is designated in network address field 173 of data part 170 and where received packet discrimination processor 302 controls packet transmitter 310 so as to transmit packets to only this network address, described above, the redundant packet generator 309 generates no redundant packet.

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[0092] Packet transmitter 310 transmits a packet to a destination network address stored in destination network address storage 303. In the case where packet communication terminal 30 receives from packet communication terminal 10 a packet in which "1" is stored in GOOD\_ADDRESS field 163 and in which a network address is designated in network address field 173 of data part 170 and where received packet discrimination processor 302 controls packet transmitter 310 so as to

transmit packets to only this network address, this transmission is carried out so that packet transmitter 310 transmits packets generated by packet generator 308, to only the network address. On the other hand, in the case where the packet communication terminal 30 receives from packet communication terminal 10 a packet in which "1" is stored in GOOD\_ADDRESS field 163 and in which no network address is designated in network address field 173 of data part 170 and where the received packet discrimination processor 302 controls packet transmitter 310 so as to transmit packets to a plurality of destination network addresses stored in packet 303, storage destination network address transmitter 310 distributes and transmits the packets generated by packet generator 308 and the redundant packets generated by redundant packet generator 309, to the plurality of destination network addresses.

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communication packet operation οf The system 1 according to the present embodiment will be described below, together with the packet communication method according to the present embodiment. described with reference to the sequence diagrams of is the processing about the and Fig. 8 Fig. 7 addresses from network notification οf packet communication communication terminal 10 to terminal 30 carried out in conjunction with soft handover to switch between connected base stations because of migration of packet communication terminal 10 from communication area 52 of base station 51 in network 50 to communication area 72 of base station 71 in network 70.

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Fig. 7 shows the processing associated with [0094] packet where handover in the case soft communication terminal 10 receives weak radio waves from the both base stations in the boundary overlapping region of the communication areas of base station 51 in network 50 and base station 71 in network 70. As shown in Fig. 7, packet communication terminal 10 is first in a state in which it is present at a location where it can receive the radio wave of high intensity from network 50 and in which it has already notified packet communication terminal 30 of network address A acquired from network 50. Here a period indicated by reference packet in which a period 500 defines numeral communication terminal 10 can receive the strong radio Let us suppose that packet wave from network 50. communication terminal 10 then moves to a location where it can receive the radio waves from both network 50 and network 70. At this time, packet communication terminal 10 acquires network address B from network 70. Then it puts "1" in ADD\_ADDRESS field 164 of the MMSP header and puts the network address B in network address field 173 of data part 170 to generate a packet, and thereafter it sends the packet as an ADD\_ADDRESS message to packet communication terminal 30 (step S11). Here a period denoted by reference numeral 502 indicates a period in which packet communication terminal 10 receives the weak radio wave from network 70. Packet communication terminal 10 receives an acknowledgment message from packet communication terminal 30 in response to this ADD\_ADDRESS message (step S12). This completes the processing about the notification of network address B.

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Since packet communication terminal 10 is [0095] able to receive the strong radio wave from network 50, it then puts "1" in GOOD\_ADDRESS field 163 of the MMSP header and puts network address A acquired from network 50, in network address field 173 of data part 170 to generate a GOOD\_ADDRESS message, and transmits it to packet communication terminal 30 (step S13). communication terminal 10 receives an acknowledgment message from packet communication terminal 30 (step S14). response to this GOOD\_ADDRESS message After receiving this GOOD\_ADDRESS message, communication terminal 30 comes to transmit packets to only the network address A.

25 [0096] Then packet communication terminal 10 further moves to a location where it can receive weak

radio waves from both networks 50 and 70. Namely, it migrates into a border region between the two networks. a period denoted by reference numeral communication in which packet indicates a period terminal 10 receives the weak radio wave from network Since there is no network from that packet 50. communication terminal 10 at this location can receive a strong radio wave, it sends a GOOD\_ADDRESS message wherein "1" is stored in GOOD\_ADDRESS field 163 of the wherein no network address header and MMSP designated in network address field 173 of data part 170, to packet communication terminal 30 (step S15). receives 10 terminal communication Packet communication packet from message acknowledgment terminal 30 having received this GOOD\_ADDRESS message (step S16). After these processes at steps S15 and S16, packet communication terminal 30 comes to transmit packets to both network addresses A and B. Let us suppose that packet communication

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terminal 10 further moves to a location where it can receive a strong radio wave from network 70. Here a period denoted by reference numeral 503 indicates a period in which packet communication terminal 10 can receive the strong radio wave from network 70. Packet communication terminal 10 having moved to this location transmits a GOOD\_ADDRESS message with the network

address B designated, to packet communication terminal (step S17). Packet communication terminal acknowledgment message from receives packet an communication terminal 30 in response GOOD ADDRESS message (step S18). After these processes at steps S17 and S18, the packet communication terminal 30 comes to transmit packets to only network address B. Then packet communication terminal 10 is assumed to move to a location where it can receive no radio wave from network 50 and receive the strong radio wave from only network 70. The packet communication terminal 10 having moved to this location sends a DELETE ADDRESS message wherein is stored DELETE ADDRESS field 165 of the MMSP header and wherein network address A is stored in network address field 173 of data part 170, to packet communication terminal (step S19). Packet communication terminal acknowledgment receives message from packet an communication terminal 30 in response to this DELETE ADDRESS message (step S20). These processes at and step S20 result in deleting the S19 destination network address equivalent to the network address A stored in destination network address storage 303 of packet communication terminal 30.

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[0099] Fig. 8 shows processing associated with soft handover in the case where the boundary

overlapping region of the communication areas of base station 51 in network 50 and base station 71 in network region where packet communication includes a 70 terminal 10 can receive strong radio waves from the both base stations. First, let us suppose that packet t.he in located is communication terminal 10 communication area of base station 51 in network 50 and can receive the strong radio wave from network 50, as In this case, packet communication shown in Fig. 8. terminal 10 has already notified packet communication terminal 30 of the network address A acquired from network 50. In Fig. 8, a period denoted by reference indicates a period in which packet 505 numeral communication terminal 10 can receive the strong radio wave from network 50. 10

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[0100] When packet communication terminal 10 further moves to a location where it can also receive a weak radio wave from base station 71 in network 70, it acquires a network address from network 70. A period denoted by reference numeral 507 is a period in which packet communication terminal 10 can receive the weak radio wave from network 70. Then packet communication terminal 10 transmits an ADD\_ADDRESS message containing the acquired network address B, to packet communication terminal 30 (step S21). Packet communication terminal 10 receives an acknowledgment message from packet

communication terminal 30 in response to this ADD\_ADDRESS message (step S22). Through these processes at steps S21 and S22, packet communication terminal 30 comes to transmit packets to the network addresses A and B.

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receive the radio wave of intensity being maximum and not less than the predetermined threshold from base station 51 in network 50, it then transmits a GOOD\_ADDRESS message containing the network address A, to packet communication terminal 30 (step S23). Packet communication terminal 10 receives an acknowledgment message from packet communication terminal 30 in response to this GOOD\_ADDRESS message (step S24). Through these processes at steps S23 and S24, packet communication terminal 30 comes to transmit packets to only the network address A.

[0102] Then packet communication terminal 10 moves to a location where it can also receive a strong radio wave from base station 71 in network 70. When the radio wave from base station 71 becomes stronger than that from base station 51 and when the intensity of the radio wave from base station 71 becomes maximum and not less than the predetermined threshold, packet communication terminal 10 transmits a GOOD\_ADDRESS message containing the network address B, to packet

communication terminal 30 (step S25). Packet communication terminal 10 receives an acknowledgment message from packet communication terminal 30 in response to this GOOD\_ADDRESS message (step S26). Through these processes at steps S25 and S26, packet communication terminal 30 comes to transmit packets to only the network address B. A period denoted by reference numeral 508 indicates a period in which packet communication terminal 10 can receive the strong radio wave from base station 71 in network 70.

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Then packet communication terminal 10 moves [0103] to a location where it can receive a weak radio wave from base station 51 in network 50 and further moves to a location where it can receive no radio wave from base In this case, packet communication 51. station transmits a DELETE\_ADDRESS message 10 terminal packet address A, to network the containing s27). (step communication terminal 30 communication terminal 10 receives an acknowledgment message from packet communication terminal response to this DELETE\_ADDRESS message (step S28). Through these processes at steps S27 and S28, packet the destination communication terminal 30 deletes network address equivalent to the network address A, which has been stored in destination network address storage 303. A period denoted by reference numeral 506 indicates a period in which packet communication terminal 10 can receive the weak radio wave from base station 51.

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Described next is the notification process [0104] of the ADD\_ADDRESS message for packet communication terminal 10 to notify packet communication terminal 30 Fig. 9 is a flowchart of a network address. processing about the notification of the network address from packet communication terminal 10 to packet communication terminal 30. In the processing about the notification of the network address, as shown in Fig. 9, packet communication terminal 10 first receives a radio wave from a new base station (step S101). network 10 sends a packet communication terminal address request message, for acquiring a network address from a network including this new base station (step S102). Packet communication terminal 10 acquires a network address assigned by the network in response to this network address request message (step S103). packet communication terminal determines 10 whether the acquired network address is one previously stored in network address storage 102 (step S104). When the result of this determination is that the above network address is one previously stored in network address storage 102, packet communication terminal 10 terminates this processing. On the other hand, when the above network address is absent in network address storage 102, this network address is stored network address storage 102 (step S105). Then network address notifying part 103 of packet communication terminal 10 sends an ADD\_ADDRESS message containing the above network address, to packet communication terminal Network address notifying part 103 30 (step S106). receive it can whether determines then response this to acknowledgment message sent in ADD\_ADDRESS message from packet communication terminal 30, within a set time (step S107). When the result of this determination is that it failed to receive the acknowledgment message within the set time, network address notifying part 103 again sends the ADD\_ADDRESS message (step S106). On the other hand, when the above determination that the is οf the result acknowledgment message was received within the time, the notification process of the network address is terminated.

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20 [0105] Described next is the notification process of the DELETE\_ADDRESS message for packet communication terminal 10 to notify packet communication terminal 30 that packet communication terminal 10 becomes no longer able to receive any radio wave from a base station previously connected, thereby requesting packet communication terminal 30 to delete a network address

acquired from a network including the base station. Fig. 10 is a flowchart showing the notification process of the DELETE\_ADDRESS message. As shown in Fig. 10, packet communication terminal 10 first measures a radio wave from a base station (step S111). Based on this communication terminal 10 packet measurement, determines whether it is within the reach of the radio wave from the base station (step S112). result of this determination is that it is within the reach of the radio wave from the base station, packet performs 10 again terminal communication measurement of the radio wave from the base station (step S111). On the other hand, when it is out of the reach of the radio wave from the base station, a network address acquired from a network including the base station is deleted from network address storage 102 (step S113). Then network address notifying part 103 sends a DELETE\_ADDRESS message containing the above network address, to packet communication terminal 30 (step S114). Network address notifying part determines whether it can receive an acknowledgment message sent in response to this DELETE\_ADDRESS message from packet communication terminal 30, within a set the result of S115). When (step determination is that the acknowledgment message was not received within the set time, network address

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notifying part 103 again sends the DELETE\_ADDRESS message (step S114). On the other hand, when the result of the above determination is that the acknowledgment message was received within the set time, the deletion process of the network address is terminated.

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Described next is processing for packet [0106] communication terminal 10 to transmit a GOOD\_ADDRESS message to packet communication terminal 30. Fig. 11 is a flowchart showing the notification process of the GOOD\_ADDRESS message. As shown in Fig. 11, radio wave intensity measuring part 104 of packet communication terminal 10 measures intensities of radio waves from respective base stations in respective networks to which packet communication terminal 10 is connected (step S121). Radio wave intensity measuring part 104 determines whether there is a radio wave with an intensity of not less than the predetermined threshold, among the intensities of the radio waves thus measured (step S122). When the result of this determination is that there are radio waves with intensities of not less than the predetermined threshold, network address notifying part 103 sends a GOOD\_ADDRESS containing a network address acquired from a network including a base station having transmitted the radio wave of the maximum intensity among them, to packet

communication terminal 30 (step S123). Network address notifying part 103 determines whether an acknowledgment response to transmitted in be message to GOOD\_ADDRESS message from packet communication terminal 30 can be received within a set time (step S124). When that the determination is of this result communication packet from message acknowledgment terminal 30 was not received within the set time, network address notifying part 103 again transmits the above GOOD\_ADDRESS message (step S123). On the other when the acknowledgment message from packet hand, communication terminal 30 is received within the set time, this processing is terminated. Returning to the determination at step S122, when there is no radio wave with an intensity of not less than the predetermined threshold, network address notifying part 103 sends a GOOD\_ADDRESS message with no designated network address S125). packet communication terminal (step Network address notifying part 103 determines whether an acknowledgment message to be transmitted in response to this GOOD\_ADDRESS message from packet communication terminal 30 can be received within a set time (step S126). When the result of this determination is that the acknowledgment message from packet communication terminal 30 was not received within the set time, network address notifying part 103 again sends the

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above GOOD\_ADDRESS message (step S125). On the other hand, when the acknowledgment message from packet communication terminal 30 is received within the set time, this processing is terminated.

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Described next is processing for packet [0107] destination а communication terminal store 30 to ADD ADDRESS in accordance with an network address message from packet communication terminal 10. Fig. 12 is a flowchart of the processing executed by packet communication terminal 30 in accordance with received ADD\_ADDRESS message. As shown in Fig. 12, packet receiver 301 of packet communication terminal 30 the ADD\_ADDRESS message from the packet receives Then received communication terminal (step S131). packet discrimination processor 302 determines whether the network address in the ADD\_ADDRESS message received by packet receiver 301 is one previously stored in destination network address storage 303 (step S132). When the result of this determination is that the above in destination network network address is absent address storage 303, received packet discrimination processor 302 makes destination network address storage 303 store this network address as a destination network address (step S133). On the other hand, when the above network address is one previously stored in destination network address storage 303, no new storage process is carried out, because this network address is already present in destination network address storage 303. For notifying packet communication terminal 10 of completion of the above processing, received packet discrimination processor 302 sends an acknowledgment message to packet communication terminal 10 (step s134).

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Described next is processing for packet [0108] 30 to delete a destination communication terminal network address in response to a DELETE\_ADDRESS message sent from packet communication terminal 10. Fig. 13 is a flowchart of the processing carried out by packet communication terminal 30 in response to the received DELETE ADDRESS message. As shown in Fig. 13, packet packet communication terminal 30 301 οf receiver receives the DELETE\_ADDRESS message sent from packet communication terminal 10 (step S141). Received packet discrimination processor 302 determines whether a network address in this DELETE\_ADDRESS message is one stored as a destination network address in destination network address storage 303 (step S142). result of this determination is that the above network address is one stored as a destination network address destination network address 303, this storage destination network address is deleted from destination network address storage 303 (step S143). On the other

hand, when the above network address is not stored as a destination network address in destination network address storage 303, the process of deleting the destination network address is not carried out. For notifying packet communication terminal 10 of completion of the above processing, received packet discrimination processor 302 sends an acknowledgment message to packet communication terminal 10 (step \$144).

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Described next is processing carried out by [0109] 10 packet communication terminal 30 in response to a GOOD\_ADDRESS message from packet communication terminal 10. Fig. 14 is a flowchart of the processing carried out by packet communication terminal 30 in response to the received GOOD\_ADDRESS message. As shown in Fig. 15 packet communication packet receiver 301 of terminal 30 receives the GOOD\_ADDRESS message sent from packet communication terminal 10 (step S151). Received packet discrimination processor 302 determines whether a network address in this GOOD\_ADDRESS message is one 20 previously stored as a destination network address in destination network address storage 303 (step S152). When the result of this determination is that the above previously stored one address is network destination network address in destination network 25 address storage 303, received packet discrimination processor 302 controls packet transmitter 310 so as to transmit packets to only this destination network address (step S153). On the other hand, when the above network address is not stored as a destination network address in destination network address storage 303, received packet discrimination processor 302 determines whether the address type and address length of the above GOOD\_ADDRESS message are "0" (step S154). When the result of this determination is that the address type and address length of the GOOD\_ADDRESS message are "0," i.e., when no network address is designated, received packet discrimination processor 302 controls packet transmitter 310 so as to transmit packets to all the destination network addresses stored in destination network address storage 303 (step S155). On the other hand, when the above GOOD\_ADDRESS message contains a network address, the message is judged as an abnormal message and the processing is terminated. communication terminal 10 packet notifying completion of the above processing, received packet discrimination processor 302 sends an acknowledgment message to packet communication terminal 10 (step S156).

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[0110] Described next is processing for packet communication terminal 30 to send packets generated from data to packet communication terminal 10 and for

packet communication terminal 10 to reconstruct the Fig. 15 is a flowchart of the processing for data. packet communication terminal 30 to transmit packets generated from data and for packet communication terminal 10 to reconstruct the data. As shown in Fig. 15, data divider 307 divides data encoded by audiovideo encoder 306 of packet communication terminal 30, to generate divisional data (step S161). It is then determined whether packet transmitter 310 is controlled to transmit packets to only one destination network result of this When the address (step S162). that packet transmitter determination is controlled to transmit packets to only one destination network address, packet generator 308 adds the MMSP header to each of the above divisional data to generate packets (step S163). Then packet transmitter 310 adds the IP header to each of the packets generated by packet generator 308, puts the above destination network address in the IP header, and sends the packets (step S164). destination network address the to Returning to the determination at step S162, when packet transmitter 310 is controlled to distribute and transmit packets to a plurality of destination network addresses stored in destination network address storage 303, redundant packet generator 309 first generates redundant data from the above divisional data (step

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Then packet generator 308 generates packets s165). with the MMSP headers added to the above divisional data and redundant packet generator 309 generates packets with the MMSP headers added to the redundant data (step S166). For distributing and transmitting the above packets to the plurality of destination network addresses stored in the destination network address storage 303, packet transmitter 310 further adds the IP header to each packet, and distributes and stores these destination network addresses into the IP headers of the respective packets. Packet transmitter 310 transmits each packet to the destination network address stored in the IP header of each packet (step S167). Packet receiver 105 of packet communication terminal 10 receives packets transmitted in this way from packet communication terminal 30 (step S168). Data reconstruction part 106 reconstructs the data from packets received by packet receiver 105 thereafter audio-video decoder 107 decodes the data (step S169). Described next is processing for packet [0111]

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[0111] Described next is processing for packet communication terminal 10 to transmit packets generated from data to packet communication terminal 30 and for packet communication terminal 30 to reconstruct data. Fig. 16 is a flowchart of the processing for packet communication terminal 10 to transmit packets generated

from data and for packet communication terminal 30 to As shown in Fig. 16, data reconstruct the data. divider 109 divides data encoded by audio-video encoder 108 of packet communication terminal 10 to generate divisional data (step S171). It is then determined whether packet transmitter 112 is controlled so as to send packets to only one network (step S172). When the result of this determination is that packet transmitter is controlled to transmit packets to only one network, packet generator 110 adds the MMSP header to each of the above divisional data to generate packets (step S173). For transmitting the packets to the above network, packet transmitter 112 then adds the IP header to each packet generated by packet generator 110, and puts the network address acquired from the above network, as a source network address into each IP header. Packet transmitter 112 transmits the packets thus generated, to the above network (step S174). Returning to the determination at step S172, when is controlled so 112 packet transmitter distribute and transmit packets to a plurality of networks, redundant packet generator 111 generates redundant data from the above divisional data Then packet generator 110 generates (step S175). packets with the MMSP headers added to the above divisional data, and redundant packet generator 111

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generates packets with the MMSP headers added to the For distributing and redundant data (step S176). transmitting the above packets to the plurality of networks to which packet communication terminal 10 is connected, packet transmitter 112 then further adds the IP header to each packet, and distributes and stores a network in plurality of network addresses stored headers οf address storage 102, into ΙP the respective packets. Packet transmitter 112 sends each packet to a network whose network address stored in the Packet IP header thereof was acquired (step S177). terminal packet communication of receiver 301 from way this in sent packets receives communication terminal 10 (step S178). When received packet discrimination processor 302 determines that "1" is stored in DATA field 161 of the MMSP header of each packet received by packet receiver 301, the packet is Then the delivered to data reconstruction part 304. data reconstruction part 304 reconstructs the data and thereafter audio-video decoder 305 decodes the data (step S179). communication packet Described next is

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[0112] Described next is packet communication program 120 for letting a packet communication terminal function as the aforementioned packet communication terminal 10. Fig. 17 shows the module configuration of packet communication program 120. As shown in Fig. 17,

packet communication program 120 comprises main module 121 in charge of processing, network address acquiring module 122, network address storing module 123, network address notifying module 124, radio wave intensity measuring module 125, packet receiving module 126, data reconstruction module 127, audio-video decoding module 128, audio-video encoding module 129, data dividing module 130, packet generating module 131, redundant packet generating module 132, and packet transmitting module 133. Here the functions of letting the packet communication terminal substantialize the operations of network address acquiring module 122, network address storing module 123, network address notifying module 124, radio wave intensity measuring module 125, packet receiving module 126, data reconstruction module 127, audio-video decoding module 128, audio-video encoding module 129, data dividing module 130, packet generating module 131, redundant packet generating module 132, and packet transmitting module 133 are similar to the respective functions of network address acquiring part 101, network address storage 102, network address notifying part 103, radio wave intensity measuring part 104, packet receiver 105, data reconstruction part 106, audio-video decoder 107, audio-video encoder 108, data divider 109, packet generator 110, redundant packet generator 111, and packet transmitter 112.

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packet communication Described next is [01131 program 320 for letting a packet communication terminal function as the aforementioned packet communication terminal 30. Fig. 18 shows the module configuration of packet communication program 320. As shown in Fig. 18, packet communication program 320 comprises main module 321 in charge of processing, packet receiving module 322, received packet discrimination processing module 323, destination network address storing module 324, data reconstruction module 325, audio-video decoding module 326, audio-video encoding module 327, dividing module 328, packet generating module 329, redundant packet generating module 330, and packet transmitting module 331. Here the functions of letting execute the communication terminal packet the operations of packet receiving module 322, received 323, processing module discrimination destination network address storing module 324, reconstruction module 325, audio-video decoding module 326, audio-video encoding module 327, data dividing module 328, packet generating module 329, redundant packet generating module 330, and packet transmitting module 331 are similar to the respective functions of packet receiver 301, received packet discrimination processor 302, destination network address storage 303, data reconstruction part 304, audio-video decoder 305,

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audio-video encoder 306, data divider 307, packet generator 308, redundant packet generator 309, and packet transmitter 310.

[0114] Packet communication program 120 and packet communication program 320 are provided, for example, by recording media such as CD-ROM, DVD, ROM, etc., or by semiconductor memories. Packet communication program 120 and packet communication program 320 may be those provided as computer data signals over a carrier wave through a network.

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of packet effect action and The [0115] communication system 1 according to the present be described below. packet In embodiment will communication system 1 of the present embodiment, when packet communication terminal 10 is present at the location where communication areas of two or more networks overlap each other, and is connectible to each of the networks, network address acquiring part 101 respective from the addresses network acquires Network address storage 102 stores these networks. network addresses and network address notifying part 103 notifies packet communication terminal 30 of these In packet communication terminal network addresses. 30, destination network address storage 303 stores the network addresses thus notified of, as respective destination network addresses. Then packet transmitter 310 of packet communication terminal 30 distributes and transmits packets generated by packet generator 308 and packets generated by redundant packet generator 309, to the destination network addresses stored in destination network address storage 303. Packet receiver 105 of packet communication terminal 10 receives packets respective destination network transmitted to the addresses in this way. When the system is constructed in this configuration wherein when packet communication position where located at the is terminal 10 communication areas of networks overlap each other, and is connectible to a plurality of networks, packet communication terminal 30 transmits packets to the respective acquired from the addresses network networks, even if packet communication terminal further moves into a state where packet communication terminal 10 is no longer able to stay connected to any one of the networks, it can receive packets transmitted through the other networks from packet communication terminal 30, without delay. The packets transmitted packet communication terminal 30 to communication terminal 10 encompass packets consisting from data generated divisional data transmitted, and packets consisting of redundant data generated by forward error correction codes from the divisional data. Packet transmitter 310 distributes

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and transmits these packets to the destination network addresses notified of by packet communication terminal 10. This distribution is implemented in such a manner that even if any one of the destination network addresses becomes ineffective, packet communication terminal 10 can receive different packets in the number equal to or greater than the number of packets generated by packet generator 308. Therefore, packet communication terminal 10 can receive packets in the number permitting recovery of the above data. As a result, packet communication terminal 10 can receive the packets transmitted from packet communication terminal 30, without delay.

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packet communication terminal In [0116] 103 sends part notifying address network DELETE\_ADDRESS message containing a network address acquired from a network to which packet communication terminal 10 is no longer able to stay connected, to packet communication terminal 30. Received packet discrimination processor 302 of packet communication terminal 30 disables a destination network address corresponding to the network address included in the above DELETE\_ADDRESS message. Namely, it deletes the above destination network address stored in destination network address storage 303. Therefore, it is feasible to cut down the waste that packet communication terminal 30 transmits packets to a network to which packet communication terminal 10 is unable to stay connected.

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When packet communication terminal 10 is [0117] connected to multiple networks, radio wave intensity measuring part 104 measures intensities of radio waves When the maximum the respective networks. intensity out of the intensities measured is not less the predetermined threshold, network notifying part 103 then sends a GOOD\_ADDRESS message containing a network address acquired from the network having transmitted the radio wave of the maximum intensity, to packet communication terminal 30. packet communication terminal 30, packet transmitter 310 then transmits packets to a destination network address corresponding to the network address included in this GOOD\_ADDRESS message. Namely, in the network transmitting the radio wave of the intensity being not less than the predetermined threshold and being maximum among the plurality of networks, it can be assumed that packet communication terminal 10 is located near a base station belonging to the network and is in a good communication state therewith, and, under a judgment that packet communication terminal 10 is able to stay the network while maintaining connected to being, packet for the time communication state

communication terminal 30 determines the above network address notified of, as a destination network address and sends packets to this destination network address. Therefore, packet communication terminal 10 can receive packets transmitted from packet communication terminal 30, without delay and it is feasible to cut down the waste of transmitting packets through all the networks to which packet communication terminal 10 can be connected.

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In packet communication terminal 10, when [0118] intensities of radio waves from multiple networks measured by radio wave intensity measuring part 104 are smaller than the predetermined threshold, network address notifying part 103 sends a GOOD\_ADDRESS message containing no designated network address, to packet Packet communication communication terminal 30. terminal 30 acknowledges that no network address is the GOOD\_ADDRESS message, and then designated in of the plurality of transmits packets to each destination network addresses stored in destination Namely, when the 303. storage network address intensities of the radio waves from the respective networks measured by radio wave intensity measuring part 104 are smaller than the predetermined threshold, the packet communication terminal 10 is determined to be located in a border region among the communication

respective networks, and the of areas communication terminal 30 transmits packets to network addresses acquired from the respective networks by packet communication terminal 10, as destination network addresses. In this configuration, even if moves from packet communication terminal the 10 boundary region of the networks into a state where it is no longer able to stay connected to any one of the networks, packet communication terminal 10 can receive through the other networks from packet packets communication terminal 30, without delay.

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When packet communication terminal 10 [0119] connectible to a plurality of networks, network address notifying part 103 transmits network addresses acquired from the respective networks, to packet communication terminal 30. Destination network address storage 303 of packet communication terminal 30 stores the network communication packet from transmitted addresses network destination respective as 10, terminal packet transmitter 112 Thereafter, addresses. distributes packet communication terminal 10 transmits packets generated by packet generator 110 and packets generated by redundant packet generator 111, to the networks to which packet communication terminal 10 Packet receiver 301 of packet can be connected. communication terminal 30 receives packets transmitted

respective networks packet from through the communication terminal 10. For example, in the case where packet communication terminal 10 is present at a location where communication areas of multiple networks overlap each other, and is connectible to the multiple networks, packet communication terminal 10 distributes and transmits packets to the connectible networks as described above; whereby, even if packet communication terminal 10 further moves into a state where it is no longer able to stay connected to any one of the transmitted from packets the networks, communication terminal 10 can be received through the other networks by packet communication terminal 30, The packets transmitted from packet without delay. 10 to packet communication communication terminal terminal 30 encompass packets consisting of divisional data generated from data to be transmitted, and packets consisting of redundant data generated by forward error correction codes from the divisional data. transmitter 112 distributes and transmits these packets packet which networks to plurality of to 10 can be connected. communication terminal distribution is implemented in such a manner that even if packet communication terminal 10 becomes no longer able to stay connected to any one of the networks, packet communication terminal 30 can receive different

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number of packets generated by packet generator 110. Therefore, packet communication terminal 30 can receive packets in the number permitting recovery of the above data. As a result, packet communication terminal 30 can receive communication terminal 30 can receive packets transmitted from packet communication terminal 10, without delay.

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The present invention can be modified in [0120] various ways without having to be limited to the abovestated embodiments. For example, in the embodiments, multiple were transmitted through packets when transmitted while were packets the networks, distributing the packets with the headers added to the divisional data obtained by dividing data transmitted, and the packets with the headers added to the redundant data generated from the divisional data, to the networks. Instead thereof, the packets with the added to the divisional data obtained by headers dividing data to be transmitted may be transmitted packet the which to networks the all through communication terminal can be connected. In this case, even if the packet communication terminal becomes no longer able to stay connected to any one of multiple networks to which the packet communication terminal is communication connected, the correspondent packet terminal can receive the packets transmitted through the other networks, without delay.